

REMARKS

This paper is in response to the Office Action mailed on March 24, 2004.

Claims 57, 58 and 59 are amended, no claims are canceled, and claim 83 and 84 are added; as a result, claims 46-47 and 57-84 are now pending in this application.

§103 Rejection of the Claims

Claims 57, 58 and 59 were rejected under 35 USC § 103(a) as being unpatentable over Shankar et al. (U.S. 4,782,380) in view of Ikeda et al. (U.S. 5,239,196).

The rejection states that newly cited reference Shankar teaches “a layer of a titanium alloy (TiW) 40 (cf. col. 3, l. 47-58) formed overlying walls of a contact hole”, and “a titanium silicide contact (produced by annealing; cf. col. 4, l. 38-51: note the sputtered barrier layer referred to in line 39 in the barrier layer 40 discussed in col. 3, l. 47-58) having a composition that is different from the layer of titanium alloy, namely; titanium silicide, the contact being directly coupled to the layer”.

The cited reference of Shankar appears to teach a physical deposition method of depositing a titanium-tungsten film (i.e. TiW) over a substrate by means of vacuum sputtering of a metal target having 10-30 wt % titanium and 70-90 wt % of tungsten (cf. col. 3, l. 54). TiW is a diffusion barrier material as is well known in the art, and noted at col. 3, l. 45, and is found in the cited reference, and has an oxidized layer 44, shown in figure 1, of from 20 to 50 angstroms, as discussed at col. 4, l. 27. The cited reference also has an additional structure of a second barrier layer 60 on top of the conductive layer 50, so that low powered oxide cleaning methods may be used to acquire low resistance second level of interconnection contacts (cf. col. 6, l. 41).

In contrast to the cited reference, independent claims 57, 58 and 59, as amended herein, each recite a layer of a titanium alloy formed overlying walls of a contact hole, wherein the titanium alloy comprises titanium and an element selected from the group consisting of zinc, cadmium, mercury, aluminum, gallium, indium, tin, silicon, germanium, lead, arsenic and antimony. Applicants respectfully submit that the difference in material of the titanium alloy is very significant in that TiW and TiN, as taught in the cited reference, are diffusion barrier materials to prevent silicon to aluminum inter diffusion, and the claimed titanium alloys are not. The claimed materials have what is known in the art as good step coverage and provide low

resistance contact structures, such as those claimed and described in the specification (cf. col. 2, l. 10-27), whereas the structures and materials of the cited reference do not.

Applicants respectfully submit that the additional cited reference of Ikeda fails to overcome the above noted deficiencies of Shankar, especially since the cited reference is only cited in the Office Action to show that the claim limitations of memory arrays, control circuits and I/O circuits are known in the art. Because the cited references, whether taken alone or in combination, do not show or suggest the elements of Applicants independent claim 57, 58 and 59, then a 35 USC § 103(a) rejection is not supportable. Reconsideration and withdrawal of the rejection is respectfully requested.

Newly added claims 83 and 84 are believed to be patentable over the known art at least because none of the known references describe or suggest the combination of features of a layer of a titanium alloy formed by chemical vapor deposition at a temperature range of 300 to 550 degrees Centigrade at a gas pressure range of 0.1 torr to 10 torr, and overlying walls of a contact hole with a step coverage of more than 90%. As discussed above with reference to the rejections of claims 57-59, the references teach physical deposition of diffusion barrier layers, which are very different structures from the claimed arrangement of a titanium alloy in direct contact with a titanium silicide contact layer. Applicants respectfully submit that new independent claim 83 is patentably distinct and nonobvious over any combination of the known art, and that there is no new matter contained in the claim. Specifically, the step coverage is defined on page 2, line 14 of the specification, and discussed in reference to the structure at least on page 4, line 15 and page 5, lines 26-29. The CVD deposition conditions are discussed at least on page 6, lines 17-21. Dependent claim 84 contains no new subject matter.

Allowable Subject Matter

Claims 46-47 and 60-82 were previously allowed. Applicants thank the Examiner for the allowance of these claims and respectfully submits that independent claims 57-59, as amended herein, and newly added claims 83 and 84 are also allowable over the cited references.

CONCLUSION

Applicants respectfully submit that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.


Respectfully submitted,

GURTEJ S. SANDHU ET AL.

By their Representatives,

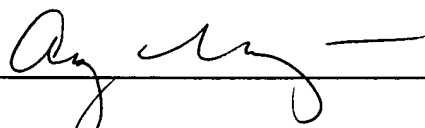
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Date 22 June '04

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 22nd day of June, 2004.

Amy Moriarty
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